CLAIMS

1.   A picture encoding apparatus for encoding input picture data to generate a plurality of hierarchy data of recursively different resolutions, comprising:

determination means for determining the quantization characteristics of a lower hierarchy data having a resolution higher than that of an upper hierarchy data, based on the activity of said upper hierarchy data having a low resolution, to quantize each hierarchy data; and

quantization means for quantizing respective hierarchy data in accordance with said determined quantization characteristics.

2.   The picture encoding apparatus according to claim 1, wherein

said determination means determines the quantization step width of the lower hierarchy data having a resolution higher than that of said upper hierarchy data for each predetermined block of respective hierarchy data, based on the quantization step width determined by the upper hierarchy data having a low resolution, to respectively quantize

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respective hierarchy data.

3.   The picture encoding apparatus according to claim 1, wherein

said determination means determines the quantized value of hierarchy data in a predetermined block in accordance with the quantization step width determined by the upper hierarchy data having a low resolution for each predetermined block, and determines the quantization step width of the lower hierarchy data having a resolution higher than that of said upper hierarchy data based on the distribution of the determined quantized value.

4.   The picture encoding apparatus according to claim 3, wherein

said determination means multiplies the quantization step width of said upper hierarchy data by a linear weight to determine the quantization step width of said lower hierarchy data.

5.   The picture encoding apparatus according to claim 3, wherein

said determination means multiplies the

quantization step width of said upper hierarchy data by a non-linear weight to determine the quantization step width of said lower hierarchy data.

6. The picture encoding apparatus according to claim 3, wherein

said determination means calculates the quantized value of hierarchy data in a predetermined block in accordance with the quantization step width determined by the upper hierarchy data having a low resolution for each predetermined block of respective hierarchy data to respectively quantize respective hierarchy data, multiplies the quantization step width of said upper hierarchy data by a gain value representing the distribution of said determined quantized value to determine the quantization step width of said lower hierarchy data, and refers the historical information of the gain value of the hierarchy data upper than said lower hierarchy data to determine the gain value representing the distribution condition of said quantized value.

7. The picture encoding apparatus according to claim 1, wherein

said determination means determines the
quantization bit number of a lower hierarchy data
having a resolution higher than that of said upper
hierarchy data for each block of respective hierarchy
data, based on the quantization step width determined
by the upper hierarchy data having a low resolution, to
respectively quantize respective hierarchy data.

8.   The picture encoding apparatus according to claim
1, wherein
        said determination means determines the quantized
value of the hierarchy data in a predetermined block in
accordance with the quantization step width determined
by the upper hierarchy data having a low resolution for
each predetermined block of respective hierarchy data,
and determines the quantization bit number of the lower
hierarchy data having a resolution higher than that of
said upper hierarchy data based on the distribution of
the determined quantized value, to respectively
quantize respective hierarchy data.

9.   The picture encoding apparatus according to claim
1, wherein

said determination means determines the quantized value of the hierarchy data in a predetermined block in accordance with the quantization step width determined by the upper hierarchy data having a low resolution for each predetermined block of respective hierarchy data, and determines the quantization bit number of the lower hierarchy data having a resolution higher than that of said upper hierarchy data based on the quantization step width of said upper hierarchy and the distribution of said determined quantized value, to respectively quantize respective hierarchy data.

10. A picture encoding method for encoding input picture data to generate a plurality of hierarchy data having a plurality of recursively different resolutions, comprising the steps of

determining the quantization characteristics of the lower hierarchy data having a resolution higher than that of an upper hierarchy data based on the activity of said upper hierarchy data having a low resolution, to respectively quantize respective hierarchy data.

11. A picture encoding apparatus for encoding input

picture signal to sequentially generate a plurality of hierarchy data having a plurality of recursively different resolutions, comprising:

determination means for determining the quantized value of the hierarchy data in the target block for each block corresponding to each other between respective hierarchies, based on the quantization step width determined by the upper hierarchy data having a resolution lower than that of the hierarchy data in the target block to be quantized, and for determining the quantization step width of the lower hierarchy data having a resolution higher than that of the hierarchy data in said target block based on the distribution condition of the determined quantized value; and

quantization means for quantizing respective hierarchy data in accordance with said determined quantization step width.

12. The picture encoding apparatus according to claim 11, wherein

respective hierarchy data excepting an uppermost hierarchy data is the inter-hierarchy difference data shown by the difference value of respective hierarchy data excepting said uppermost hierarchy data and the

adjacent upper hierarchy data.

13. The picture encoding apparatus according to claim 11, wherein

said determination means multiplies the quantization step width for said upper hierarchy data by the value showing the distribution of said determined quantized value to determine the quantization step width for said lower hierarchy data.

14. The picture encoding apparatus according to claim 13, wherein

said determination means multiplies the quantization step width for said upper hierarchy data by the linear weight indicating the distribution of said determined quantized value to determine the quantization step width for said lower hierarchy data.

15. The picture encoding apparatus according to claim 14, wherein

said linear weight converges to "1" as the quantization step width of said upper hierarchy data becomes large.

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16. The picture encoding apparatus according to claim 13, wherein

said determination means multiplies the quantization step width for said upper hierarchy data by the non-linear weight showing the distribution of said determined quantized value to determine the quantization step width for said lower hierarchy.

17. The picture encoding apparatus according to claim 16, wherein

said non-linear weight converges to "1" as the quantization step width of said upper hierarchy data becomes large.

18. The picture encoding apparatus according to claim 11, wherein

said determination means determines based on calculation of the pixel value of the pixel to be quantized which is contained in the block to be quantized of said uppermost hierarchy data and the pixel value of adjacent pixel neighboring the pixel to be quantized, to determine the quantization step width to quantize the uppermost hierarchy data having a lowest resolution.

19. The picture encoding apparatus according to claim 11, wherein

said determination means forms a virtual upper hierarchy data having a resolution lower than that of said uppermost hierarchy data from said uppermost hierarchy data, thereafter determines the quantization step width to quantize the uppermost hierarchy data having a lowest resolution based on the calculation of the virtual upper hierarchy data and said uppermost hierarchy data corresponding to the virtual upper hierarchy data.

20. The picture encoding apparatus according to claim 11, wherein

said determination means fixes on a value for the quantization step width of the uppermost hierarchy data having a lowest resolution.

21. A picture encoding method for encoding input picture signal to sequentially generate a plurality of hierarchy data having a plurality of recursively different resolutions, comprising the steps of:

determining the quantized value of the hierarchy

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data in the target block for each block corresponding
to each other between respective hierarchies, based on
the quantization step width determined by the upper
hierarchy data having a resolution lower than that of
the hierarchy data in the block to be quantized, and
determining the quantization step width of the lower
hierarchy data having a resolution higher than that of
the hierarchy data in the target block based on the
distribution of the determined quantized value; and

transmitting respective hierarchy data quantized
in accordance with said determined quantization step
width.

22.   A picture encoding apparatus for encoding input
picture signal to sequentially generate a plurality of
hierarchy data having a plurality of recursively
different resolutions, comprising:

determination means for determining the quantized
value of the hierarchy data in the target block for
each block corresponding to each other between
respective hierarchies, based on the quantization step
width determined by the upper hierarchy data having a
resolution lower than that of the hierarchy data in the
block to be quantized, and for determining the

quantization step width of the lower hierarchy data having a resolution higher than that of said upper hierarchy data based on the history of the distribution of the quantized value of the hierarchy data upper than the lower hierarchy data having a resolution higher than that of the hierarchy data in said target block; and

quantization means for quantizing respective hierarchy data in accordance with said determined quantization step width.

23. The picture encoding apparatus according to claim 22, wherein

respective hierarchy data excepting said uppermost hierarchy data is the inter-hierarchy difference data shown by the difference value of respective hierarchy data excepting said uppermost hierarchy data and the adjacent upper hierarchy data.

24. The picture encoding apparatus according to claim 22, wherein

said determination means multiplies the quantization step width for said upper hierarchy data by the gain value showing the distribution of said

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determined quantized value to determine the
quantization step width for said lower hierarchy data,
and refers the historical information of the gain value
of the hierarchy data upper than said lower hierarchy
data to determine the gain value showing the
distribution of said quantized value.

25.   The picture encoding apparatus according to claim
22, wherein
       said determination means determines the
quantization step width to quantize the uppermost
hierarchy data having a lowest resolution, based on the
calculation of the pixel of the pixel to be quantized
which is contained in the block to be quantized of said
uppermost hierarchy data and the pixel of the adjacent
pixel neighboring the pixel to be quantized.

26.   The picture encoding apparatus according to claim
22, wherein
       said determination means forms the virtual upper
hierarchy data having a resolution lower than that of
said uppermost hierarchy data from said uppermost
hierarchy data, and determines the quantization step
width to quantize the uppermost hierarchy data having a

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lowest resolution based on the calculation of the virtual upper hierarchy data and said uppermost hierarchy data corresponding to the virtual upper hierarchy data.

27. The picture encoding apparatus according to claim 22, wherein

said determination means fixes on the value for the quantization step width of the uppermost hierarchy data having a lowest resolution.

28. A picture encoding method for encoding input picture signal to sequentially generate a plurality of hierarchy data having a plurality of recursively different resolutions, comprising the steps of:

determining the quantized value of the hierarchy data in said target block for each block corresponding to each other between respective hierarchies based on the quantization step width determined by the upper hierarchy data having a resolution lower than that of the hierarchy data in the block to be quantized, and determining the quantization step width of the lower hierarchy data having a resolution higher than that of said upper hierarchy data based on the history of the

distribution condition of the quantized value of the lower hierarchy data having a resolution higher than that of the hierarchy data in said target block; and

transmitting respective quantized hierarchy data in accordance with said determined quantization step width.

29. A picture encoding apparatus for encoding input picture signal to sequentially generate a plurality of hierarchy data having a plurality of recursively different resolutions, comprising:

determination means for determining the quantization bit number of lower hierarchy having a resolution higher than that of the hierarchy data in said target block for each block corresponding to each other between respective hierarchies, based on the determined quantization step width by the upper hierarchy data having a resolution lower than that of the hierarchy data in the block to be quantized; and

quantization means for quantizing respective hierarchy data in accordance with said determined quantization bit number.

30. The picture encoding apparatus according to claim

29, wherein

said determination means multiplies the quantization bit number of said upper hierarchy data by the value determined by the quantization step width of said upper hierarchy data to determine the quantization bit number of said lower hierarchy data.

31. The picture encoding apparatus according to claim 30, wherein

said determination means multiplies the quantization bit number of said upper hierarchy data by the value determined by the distribution of said quantized value to determine the quantization bit number of said lower hierarchy data.

32. A picture encoding method for encoding input picture signal to sequentially generate a plurality of hierarchy data having a plurality of recursively different resolutions, comprising the steps of:

determining the quantization bit number of the lower hierarchy data having a resolution higher than that of the hierarchy data in said target block for each block corresponding to each other between respective hierarchies, based on the quantization step

width determined by the upper hierarchy data having a resolution lower than that of the hierarchy data in the block to be quantized, to respectively quantize respective hierarchy data; and

transmitting respective hierarchy data quantized in accordance with said determined quantization bit number.

33. A picture encoding apparatus for encoding input picture signal to sequentially generate a plurality of hierarchy data having a plurality of recursively difference resolutions, comprising:

determination means for determining the quantized value of the hierarchy data in said target block for each block corresponding to each other between respective hierarchies, based on the quantization step width determined by the lower hierarchy data having a resolution lower than that of the hierarchy data in the block to be quantized, to respectively quantize respective hierarchy data, and for determining the quantization bit number of the lower hierarchy data having a resolution higher than that of hierarchy data in said target block; and

quantization means for quantizing respective

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hierarchy data in accordance with said determined quantization bit number.

34. A picture encoding method for encoding input picture signal to sequentially generate a plurality of hierarchy data having a plurality of recursively different resolutions, comprising the steps of:

determining the quantized value of the hierarchy data in said target block for each block corresponding to each other between respective hierarchies based on the quantization step width determined by the upper hierarchy data having a resolution lower than that of the hierarchy data in the block to be quantized, and determining the quantization bit number of the lower hierarchy data having
a resolution higher than that of the hierarchy data in said target block; and

transmitting respective quantized hierarchy data in accordance with said determined quantization bit number.

35. A picture encoding apparatus for encoding input picture signal to sequentially generate a plurality of hierarchy data having a plurality of recursively

different resolution, comprising:

determination means for determining the quantized value of the hierarchy data in the block excepting the uppermost hierarchy data having a lowest resolution for each block corresponding to each other between respective hierarchies based on the quantization step width determined by the upper hierarchy data having a low resolution, and for determining the quantization bit number of lower hierarchy data having a resolution higher than that of said upper hierarchy data based on the quantization step width of said upper hierarchy and the distribution condition of said determined quantized value; and

quantization means for quantizing respective hierarchy data in accordance with said determined quantization bit number.

36. The picture encoding apparatus according to claim 35, wherein

said determination means multiplies the quantization bit number of said upper hierarchy data by the value determined by the quantization step width of said upper hierarchy data and the distribution of said quantized value, to determine the quantization bit

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number of said lower hierarchy data.

37.   The picture encoding apparatus according to claim
29, 33, or 35, wherein

respective hierarchy data excepting said uppermost
hierarchy data is the inter-hierarchy difference data
shown by the difference value of respective hierarchy
data excepting said uppermost hierarchy data and the
adjacent upper hierarchy data.

38.   The picture encoding apparatus according to claim
29, wherein

said determination means determines the
quantization step width to quantize the uppermost
hierarchy data having a lowest resolution, based on the
calculation of the pixel value of pixel to be quantized
which is contained in the block to be quantized of said
uppermost hierarchy data and the pixel value of
adjacent pixel neighboring the pixel to be quantized.

39.   The picture encoding apparatus according to claim
29, wherein

said determination means forms the virtual upper
hierarchy data having a resolution lower than that of

said uppermost hierarchy data from said uppermost
hierarchy data, thereafter determines the quantization
step width for quantizing the uppermost hierarchy data
having a lowest resolution, based on the calculation of
the virtual upper hierarchy data and said uppermost
hierarchy data corresponding to the virtual upper
hierarchy data.

40. The picture encoding apparatus according to claim
29, wherein

said determination means fixes on value for the
quantization step width of the uppermost hierarchy data
having a lowest resolution.

41. A picture encoding apparatus for encoding input
picture signal to sequentially generate a plurality of
hierarchy data having a plurality of recursively
different resolutions, comprising:

a means for determining the quantization step
width of the lower hierarchy data having a resolution
higher than said upper hierarchy data for each
predetermined block of respective hierarchy data based
on the quantization step width determined by the upper
hierarchy data having a low resolution, and for

quantizing the uppermost hierarchy data having a lowest resolution by the fixed quantization step width; and

quantization means for quantizing respective hierarchy data in accordance with said respective quantization step width.

42. A picture encoding method for encoding input picture signal to sequentially generate a plurality of hierarchy data having a plurality of recursively different resolutions, comprising the steps of:

determining the quantization step width of the lower hierarchy data having a resolution higher than that of said upper hierarchy data for said respective predetermined block of respective hierarchy data based on the quantization step width determined by the upper hierarchy data having a low resolution, and quantizing the uppermost hierarchy data having a lowest resolution by the fixed quantization step width; and

transmitting respective quantized hierarchy data in accordance with said respective quantization step width.

43. A picture encoding apparatus for encoding input picture signal to sequentially generate a plurality of

hierarchy data having a plurality of recursively different resolutions, comprising:

a means for determining the quantization step width of the lower hierarchy data having a resolution higher than that of said upper hierarchy data for each predetermined block of said respective hierarchy data based on the quantization step width determined by the upper hierarchy data having a low resolution, and for determining the quantization step width for quantizing the uppermost hierarchy data having a lowest resolution based on the calculation of the pixel value of the pixel to be quantized which is contained in the block to be quantized of said uppermost hierarchy data and the pixel value of the adjacent pixel neighboring the pixel to be quantized; and

quantization means for quantizing respective hierarchy data in accordance with said respective quantization step width.

44. The picture encoding apparatus according to claim 43, wherein

said determination means determines the quantization step width of said uppermost hierarchy data, based on the calculation of the pixel value of

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the pixel to be quantized which is contained in the block to be quantized of said uppermost hierarchy data and the four pixels adjacent to the pixel to be quantized in the horizontal and vertical directions.

45. The picture encoding apparatus according to claim 43, wherein

said determination means determines the quantization step width to quantize the uppermost hierarchy data having a lowest resolution, based on the calculation of the pixel value of the pixel to be quantized which is contained in the block to be quantized of said uppermost hierarchy data and the eight pixels adjacent to the pixel to be quantized.

46. The picture encoding apparatus according to claim 43, wherein

said determination means determines the quantization step width to quantize the uppermost hierarchy data having a lowest resolution, based on the calculation of the pixel value of the pixel to be quantized which is contained in the block to be quantized of said uppermost hierarchy data and the pixel of a plurality of adjacent pixels adjacent to the

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pixel to be quantized, and the pixel value of said plurality of adjacent pixels contains the value corresponding to the distance from said pixel to be quantized to the respective pixels.

47. A picture encoding method for encoding input picture signal to sequentially generate a plurality of hierarchy data having a plurality of recursively different resolutions, comprising the step of:

determining the quantization step width of the lower hierarchy data having a resolution higher than that of said upper hierarchy data for each predetermined block of respective hierarchy data based on the quantization step width determined by the upper hierarchy data having a low resolution, and determining the quantization step width to quantize the uppermost hierarchy data having a lowest resolution based on the calculation of pixel value of pixel to be quantized which is contained in the block to be quantized of said uppermost hierarchy data and the pixel value of adjacent pixel adjacent to the pixel to be quantized; and

transmitting respective quantized hierarchy data in accordance with respective quantized step width.

48. A picture encoding apparatus for encoding input picture signal to sequentially generate a plurality of hierarchy data having a plurality of recursively different resolutions, comprising:

determination means for determining the quantization step width of the lower hierarchy data having a resolution higher than that of said upper hierarchy data for each predetermined block of respective hierarchy data based on the quantization step width determined by the upper hierarchy data having a low resolution, and after forming the virtual upper hierarchy data having a resolution lower than that of said uppermost hierarchy data from said uppermost hierarchy data, for determining the quantization step width to quantize the uppermost hierarchy data having a lowest resolution based on the calculation of the virtual upper hierarchy data and said uppermost hierarchy data corresponding to the virtual upper hierarchy data, to respectively quantize respective hierarchy data; and

quantization means for quantizing respective hierarchy data in accordance with said respective quantization step width.

49. The picture encoding apparatus according to claim 48, wherein

said determination means calculates said virtual upper hierarchy data by average of a plurality of corresponding uppermost hierarchy data.

50. The picture encoding apparatus according to claim 41, 43, or 48, wherein

said determination means determines the quantized value of the hierarchy data in said predetermined block for each predetermined block of hierarchy data based on the quantization step width determined by the upper hierarchy data having a resolution lower than that of the hierarchy data in the block to be quantized, and determines the quantization step width of the lower hierarchy data having a resolution higher than that of said upper hierarchy data based on the distribution of the determined quantized value, to respectively quantize respective hierarchy data.

51. A picture encoding method for encoding input picture signal to sequentially generate a plurality of hierarchy data having a plurality of recursively

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different resolutions, comprising the step of:

determining the quantization step width of the lower hierarchy data having a resolution higher than that of said upper hierarchy data for each predetermined block of respective hierarchy data based on the quantization step width determined by the upper hierarchy data having a low resolution, and after forming the virtual upper hierarchy data having a resolution lower than that of said uppermost hierarchy data from said uppermost hierarchy data, determining the quantization step width to quantize the uppermost hierarchy data having a lowest resolution based on the calculation of the virtual upper hierarchy data and said uppermost hierarchy data corresponding to the virtual upper hierarchy data, to respectively quantize said respective hierarchy data; and

transmitting respective quantized hierarchy data in accordance with said respective quantized step width.

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